

# The 1975 S-MTT National Lectureship

## THE DEVELOPMENT OF MODERN AUTOMATIC SYSTEMS FOR THE MEASUREMENT OF NETWORK PARAMETERS

THE development of modern computer-controlled measurement systems has given the microwave engineer a fantastic tool for the design and testing of components and systems. Going beyond the point of fast, automatic measurements, they now give promise of high accuracy and are revolutionizing the microwave measurement field.

This development has been due mainly to advances in solid-state integrated-circuit technology as applied to computers and digital instruments, the accompanying software development, and to improvements in pulse generation, sampling, and switching.

These advances have led to the availability of smaller, cheaper instrumentation computers and calculators, "smart" digital instruments, frequency-agile signal sources, high-speed CRT displays, etc.

The standardization of interface levels, codes, and computer languages has become desirable. Efforts are currently underway to obtain international approval through the IEC of a standard interface bus for computer-controlled measurement systems.

It has become easier to assemble the necessary equipment, write the required software, and produce computer-controlled measurement systems. Interest is being revived in measurement techniques that were formerly considered impractical because of tedious and time-consuming procedures.

This year's National Lecture emphasizes the principles and ideas which led to the development of modern automatic systems. The measurement of network parameters is surveyed.<sup>1</sup> In addition, other ideas for automation of portions of measurement processes are reviewed because some of these principles might be used in future developments. Creative thinkers who were responsible for these ideas are acknowledged. The particular developments which improved accuracy are highlighted and problems in achieving good accuracy are frankly discussed.

The question of what will happen next in this active field is cautiously addressed, recognizing that foresight is greatly inferior to hindsight.

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<sup>1</sup> R. W. Beatty, "Automatic measurement of network parameters—A survey," National Bureau of Standards Monograph 151, to be published.



Robert W. Beatty (S'43-M'50-SM'53-F'67) received the B.S.E.E. degree from George Washington University, Washington, D.C., in 1939, the S.M. degree in electrical communication from the Massachusetts Institute of Technology, Cambridge, Mass., in 1943, and the Ph.D. degree in engineering from the University of Tokyo, Tokyo, Japan, in 1972.

From 1940 to 1942 he was employed at the Naval Research Laboratory, Washington D.C., in work on underwater sound and radio-direction finding. He was a Staff Aide at the M.I.T. Radar School in 1943 and served in the U.S. Naval Reserve from 1943 to 1946. He performed research on Radar Fire Control at the Naval Research Laboratory in 1944 and was stationed at the Radio Material Office, Pearl Harbor Navy Yard from 1945 to 1946. He has had several years experience in the field of consulting radio engineering for the radio broadcasting industry. From 1948 to 1974 he was employed by the National Bureau of Standards, working in the field of microwave standards, and was Chief of the Microwave Circuit Standards at NBS, Boulder, Colo., from 1955 to 1962. From 1970 to 1972 he was a Guest Worker at the Electrotechnical Laboratory, Tokyo, Japan. He is currently a Consulting Electronics Engineer in Boulder, Colo. He is coauthor with Dr. D. M. Kerns of the book: *Basic Theory of Waveguide Junctions and Introductory Microwave Circuit Analysis* and has written numerous monographs and technical papers.

Dr. Beatty was Past Chairman of U.S. Comm I, URSI; has served on the S-MTT Administrative Committee since 1961, was Editor of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES from 1963 to 1965, and Chairman of Technical Program Committees for the 1952 and 1973 MTT Symposia.